OPEN-PORE METAL COATING FOR JOINT REPLACEMENT IMPLANTS AND METHOD OF PRODUCTION

Patent claims

1. Open-pored biocompatible surface layer for an implant, which layer is arranged on a virgin surface of the implant, characterised in that

the layer thickness of the open-pored surface layer is in the range from 0.1 mm to 2.5 mm, preferably in the range from 0.3 mm to 1.9 mm and especially in the range from 0.5 mm to 1.5 mm;

the porosity of the open-pored surface layer is in the range from 20% to 85% preferably in the range from 30% to 70% and especially in the range from 35% to 65%.

2. Surface layer according to claim 1, characterised in that

the open-pored surface layer has pits, especially etching pits, having a diameter in the range from 0.1 μm to 2.5 μm, preferably in the range from 0.5 μm to 1.9 μm and especially in the range from 0.8 μm to 1.5 μm.

3. Surface layer according to one of claims 1 or 2, characterised in that

the open-pored surface layer has a shallow roughening in the sub-micrometre range.

4. Surface layer according to one of the preceding claims, characterised in that

biocompatible particles, especially of titanium dioxide or calcium phosphate, are arranged on the implant surface.

5. Surface layer according to claim 4, characterised in that

the biocompatible particles have a particle size in the range from 0.01 μm to 5 μm, preferably in the range from 0.1 μm and 3 μm and especially in the range from 0.2 μm to 1 μm.

6. Surface layer according to one of claims 1 to 3, characterised in that

the open-pored surface layer consists substantially of titanium, zirconium, niobium or tantalum.

7. Surface layer according to one of claims 1 to 4, characterised in that

the open-pored surface layer is sintered.

8. Method of producing an open-pored coated implant, especially a joint replacement implant, characterised by the following steps:

application of at least one layer of a biocompatible metal or an alloy thereof to a virgin surface of the implant, to produce an implant surface,

production of a surface micro-structure on the implant surface by means of etching of the implant surface and/or application of fine biocompatible particles to the implant surface.

9. Method according to claim 8, characterised in that

the biocompatible metal is applied by means of a vacuum plasma spraying method.

10. Method according to claim 8, characterised in that

the biocompatible metal is applied by brushing, spreading, spraying or like application techniques.

11. Method according to one of claims 8 to 10, especially according to claim 10, characterised in that

the at least one layer applied to the virgin surface of the implant is sintered.

12. Method according to claim 11, characterised in that

binders and/or sintering adjuvants are used.

13. Method according to claim 12, characterised in that

as sintering adjuvant there is used a sintering adjuvant metal which, together with the biocompatible metal or alloy thereof, forms a low-melting eutectic, especially silicon or cobalt, preferably in elemental powder form.

14. Method according to one of claims 11 to 13, characterised in that

sintering is carried out *in vacuo*.

15. Method according to one of claims 11 to 14, characterised in that

sintering comprises a debindering and/or dehydrogenation phase.

16. Method according to one of claims 11 to 15, characterised in that

a sintering temperature in the range from 800°C to 1500°C, preferably in the range from 950°C to 1400°C and especially in the range from 1000°C to 1350°C is used.

17. Method according to one of claims 8 to 16, characterised in that

the biocompatible metal is used in powder form, especially in the form of an angular powder.

18. Method according to one of claims 8 to 17, characterised in that

a layer thickness of the open-pored surface layer in the range from 0.1 mm to 2.5 mm, preferably in the range from 0.3 mm to 1.9 mm and especially in the range from 0.5 mm to 1.5 mm is produced.

19. Method according to one of claims 8 to 18, characterised in that

the biocompatible metal applied to the virgin surface of the implant has a particle size in the range from 50 μm to 800 μm, preferably in the range from 100 μm to 650 μm and especially in the range from 200 μm to 550 μm.

20. Method according to one of claims 8 to 19, characterised in that

the biocompatible metal is titanium, zirconium, niobium or tantalum.

21. Method according to one of claims 10 to 20, characterised in that

the biocompatible metal is used in the form of a metal hydride powder.

22. Method according to one of claims 8 to 21, characterised in that

the etching of the implant surface is carried out by means of acid (bath) etching and/or by means of plasma etching, especially oxygen plasma.

23. Method according to one of claims 8 to 22, characterised in that

the fine biocompatible particles have a particle size in the range from 0.01 μm to 5 μm, preferably in the range from 0.1 μm to 3 μm and especially in the range from 0.2 μm to 1 μm.

24. Method according to one of claims 8 to 23, characterised in that

the fine biocompatible particles are applied by a sol-gel method using a binder, preferably a silicate-based binder.

25. Method according to one of claims 8 to 24, characterised in that

titanium dioxide, calcium phosphate or another biocompatible material is used as material for the fine biocompatible particles.

26. Implant, especially a joint replacement implant, characterised by a surface layer according to one of claims 1 to 7.

27. Use of a surface layer according to one of claims 1 to 7 for femoral stems, sockets for hip joints, femoral components for a knee joint replacement, tibial components for a knee joint replacement, components for a shoulder joint replacement, components for an elbow joint replacement, components for a toe joint replacement, components for a finger joint replacement, for a component for the fusion of vertebral bodies of the lumbar spine, for components for an intervertebral disc replacement, for transgingival implant systems, for orthodontic implant systems and tooth (replacement) implants.